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MIDDLE SOUTH UTILITIES SYSTEM

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February 14, 1983

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Q-3-P43

Mr. T. M. Novak
Assistant Director for Licensing
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

SUBJECT: Louisiana Power & Light Company
Waterford SES Unit No. 3
Docket No. 50-382
Installation of Fire Protective
Envelope for Class IE
Electrical Cables
Use of the Insulco/HEMYC System

Dear Mr. Novak:

In accordance with an agreement made during a telecon with Mr. D. Kubeckie on January 11, 1983, we are formally acknowledging our intent of using the Insulco/HEMYC System as our fire protective envelope for Class IE electrical cables.

In addition, we are addressing four items of concern that Mr. Kubeckie made reference to during the telecon.

Attached to this letter you will find the following information:

1. LP&L's response to the NRC's concern with the temperature levels achieved on the unexposed side of the protective envelope.

2. LP&L's response to the reasoning for utilizing 24 Volts DC as a circuit integrity monitoring voltage.

3. LP&L's response concerning installation and QA/QC procedures.

4. LP&L's response to the NRC's concern over not protecting the structural supports associated with the cable trays and conduits being protected.

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5. A comparison of the HEMYC System fire test to the Sandia 20 ft. separation test and CMEB 9.5.1.

6. NES/Insulco HEMYC System presentation data.

7. Fire Qualification Test Report - HEMYC Cable Wrap System

LP&L believes this information should aid the NRC in their evaluation of the Insulco/HEMYC System for use as a fire protective envelope for Class IE electrical cables.

If you have any questions or comments on this matter, please contact Mr. Roy Prados, our Licensing Engineering Supervisor.

Yours very truly,

L. V. Maurin

LVM/EJS/sm

Attachment

cc: E. L. Blake, W. M. Stevenson, Jim Wilson, D. Kubeckie

bcc: (without attachments) Ebasco (2), J. M. Brooks, R. J. Milhiser (2),
F. J. Drummond, T. F. Gerrets, C. J. Decareaux, T. K. Armington,
P. V. Prasankumar, J. R. McGaha, Richard Hymes, L. L. Bass,
M. I. Meyer, R. W. Prados, K. R. Iyengar, Central Records,
L. V. Maurin, R. P. Barkhurst, G. B. Rogers, Nuclear Records (3),
Licensing Library, MSS Nuclear Activities (w/Att), G. Buxton

TEMPERATURE

In addressing the NRC concern of the temperature of the unexposed side of the fire protective envelope, it should be noted that no firm criteria exists related to the qualification of the envelope based on internal temperature reached during a fire test. Qualification of the protective envelope system is based primarily on circuit integrity and insulation degradation. A review of criteria set forth by the involved organizations (i.e., NRC, ANI, and ASTM) indicates the following:

NRC -

- No criteria has been established pertaining to the protective envelope system other than the envelope should have a 1 hr rating (refer to BTP CMEB 9.5-1, Position C.5.b. (2) (c)).
- A reference to a maximum temperature of 325°F (on the unexposed side) is stated in C.5.a. (1) (b). However, this criteria is in reference to fire barrier penetration seals designed to prevent ignition of near by combustibles and not applicable to tray or conduit protective envelopes. The results of a review of NRC-CMEB 9.5-1 performed by Nuclear Energy Services (NES) supports this conclusion (refer to "Comparison of HEMYC System Fire Test to Sandia 20 ft Separation Test and CMEB 9.5-1).

ANI -

- The protective envelope shall be exposed to fire test (ASTM E-119) and followed by a hose stream test.
- Maximum internal temperature of the protective envelope is not stipulated.
- Pass/fail criterion is defined as the ability of the protected circuits to maintain continuity and prevent a faulted condition.

ASTM -

- o The scope of the documents issued by this organization are basically the fire testing of building materials (i.e., walls, doors, etc.), and does not consider fire protective envelopes.
- o Documents, such as E-119, are referred to for the temperature vs time.
- o A criterion of 250°F plus ambient temperature has been established for the unexposed side of the fire barrier, and not considered as applicable to cable protective envelopes (refer to NRC criteria above).

Summarizing the above, no firm criteria has been established for the qualification of a cable protective envelope based on internal envelope temperature; qualification is based primarily on circuit integrity and maintenance of cable insulation.

A review of the NES study, "Comparison of HEMYC System Fire Test to Sandia 20 ft Separation Test and CMEB 9.5-1", indicated the following:

1) The cables had maintained circuit continuity during the fire qualification tests and subsequent hose stream tests.
2) Faulted conditions did not exist as indicated by insulation resistance tests. These tests resulted in minimum values of 600 to ∞ MΩ for direct wrap conduit cables and 150 to ∞ MΩ for the tray cables. (15 MΩ is considered to be adequate by industry standards).
3) No physical damage to the cables had occurred which could adversely effect the functionability of the cable.
4) Maximum thermocouple temperatures for all three tests never exceeded 180°C (356°F) at the 50-minute mark of the one-hour test and only one recorded as high as 215°C (419°F) in single-layered tray and 210°C (410°F) for direct-wrap conduit at the 60-minute end point of the test. It should be noted that these

(4 cont.) temperatures are ambient air temperatures within the envelope; actual cable jacket temperatures would be lower than those listed above; additionally, the conductor (which is insulated by the jacket) would be at a substantially lower temperature.

As indicated by the NES report, the HEMYC tests resulted in no cable damage, no loss of circuit integrity, or degradation of cable insulation resistance below acceptable industry standards. Since circuit and insulation integrity are the only applicable criteria, it is concluded that the HEMYC system adequately demonstrated its ability to protect cable during a one hour (ASTM E-119) fire qualification test and subsequent hose stream tests. This conclusion is supported by ANI's approval of the system for use at Waterford 3.

Additional conservatism is provided by the fact that PE/PVC cable (low-temperature thermo-plastics) were utilized in the B&B test, where-as the cable utilized at Waterford (Qualified IEEE-383 cable; qualified to LOCA and MSLB conditions) is of a much more superior construction.

24 Volts DC Monitoring Voltage

Three tests were conducted for a variety of insulation wrapping and cable mix configurations for both cable trays and conduits exposed to the standard time-temperature curve defined by ASTM E-119. During each test, control cables were energized with 24 volts dc, and connected to a light detection system which indicated the occurrence of short circuits. These tests were conducted with 24v dc in lieu of full power to the cables for reasons of personnel safety. The hose stream test required after the fire test to ensure circuit integrity could be very dangerous to the personnel conducting such testing. Since B&B could not conduct this test with full power, a third party megger test of the cables was conducted after the fire and hose stream test.

The "megger" tests (at 500v for a minimum of 30 seconds) were performed to establish insulation resistance values of the cable and, in addition, a visual examination was conducted to evaluate any visible damage to the cable jackets.

Furthermore, the criteria used for testing was the ANI standard, which does not address a value of voltage to use for ensuring circuit integrity. B&B knows of no independent testing facility utilizing rated cable voltages during ASTM E-119 fire testing of cable envelope systems.

Installation Specifications

The B&B Quality Assurance Department shall be responsible for ensuring that the HEMYC cable wrap system installed at Waterford-3 is identical to the system that was installed during the third party fire qualification test. The following B&B Installation and Quality Control procedures shall be utilized on the installed system to ensure compliance to the system as tested.

INSTALLATION PROCEDURES

8400.101 - Installation Procedure for B&B Insulation Cable Tray Protection System - Straight Sections

8400.102 - Installation of Insulco/HEMYC Cable Tray Protection System - Curved Sections

8400.103 - Installation of Insulco/HEMYC Cable Tray Protection System onto Single or Multiple Conduits

8400.104 - Repair and Installation of the Insulco/HEMYC Cable Tray Protection System Around Interferences and Obstructions

8400.105 - Manufacture of Insulco/HEMYC Cable Tray and Conduit Protection System Components

Quality Control Procedures

QCP 10001 - Shipping, Handling & Storage for Insulco/HEMYC Protective Wrap Components

QCP 10002 - Manufacturing Inspection for Insulco/HEMYC Protective Wrap Components

QCP 10003 - Installation Inspection Criteria for Insulco/HEMYC Protective Wrap Components

Protection of Structural Supports

It is L, P, and L's position that structural supports, associated with fire protected cable trays and conduits, not be provided with a fire protection coating. It is readily recognized that all structural steel assemblies utilized in commercial and utility applications are not provided with fire resistant materials. The need, extent, and type of structural steel fire protection is based primarily on the anticipated combustible loading of the area, type of occupancy, design loading of the structural members, and the structural steel shape, size, and configuration. In addition, it is an accepted practice that structural steel inherently contains a degree of fire resistance in itself; this resistance is a function of the steel mass, and the exposed heated surface.

Since the draft issuance of Appendix "R" it had been understood by L, P, and L that several options for the protection of essential cable were available to the utilities, i.e.:

1. Separation of redundant trains by a three hour fire barrier, and the protection of structural steel that comprise the barrier;

2. Protection of one of the reduntant trains by a one hour fire barrier, plus the installation of an automatic sprinkler system and fire detection systems [with no requirment for the protection of tray or conduit supports];

3. Separation of essential cable and equipment by clear (non-combustible) space.

With regard to option (2) - the discussion of the need for a one hour fire protection for cables, which appears in the comments/resolution section of the draft Appendix "R" indicates that the purpose of the one hour protective barrier is to allow for <u>interim</u> protection of essential cable (i.e., preclude essential cable from being adversily effected by a fire condition which might exist prior to the activation of an automatic sprinkler system).

L, P, and L accepts this position that a one hour fire protective envelope will assure the integrity of essential cable, and can provide a one hour barrier, sprinklers, and fire detection for these areas. We have found no specific requirement by NRC, or any other authority, which requires protection for cable supports - only that the barrier system be tested to E-119 criterion.

The ASTM E-119 time/temperature curve, used primarily for evaluating building material fire resistance, is presently being utilized in the evaluation of fire protective systems for cable tray and conduits. Although the application of the ASTM E-119 temperature curve may be justifiable in the above cases, it is not reasonable to assume that a credible fire condition, throughout the fire area of the RAB, would approach the severity which is represented by

the E-119 temperature/time response for the following reasons:

a. Combustible Loading - The Fire Hazard Analysis that the RAB is considered to contain negligible in situ combustibles. Considering the appition of transient combustibles the fire load would not approach the combustibles required to fuel an E-119 furnace. For example,a typical E-119 furnace would require approximately 2,200,000 BTU of heat input, an equivalent of 17 gallons of gasoline. It is obvious that administrative procedures, and lack of sufficient space would prohibit the transportation and storage of such quantities of combustibles within the RAB. In addition, there are no areas within the RAB containing essential cable which approximate the furnace compartment size of 5'x6'x8'. The RAB fire areas are all larger in volume (most very much larger). Therefore, the required combustibles needed to provide a E-119 time/temperature response would also be proportionably larger. This adds additional assurance that the necessary combustible load would never exist in the RAB areas.

b. Boundary Conditions - The typical E-119 furnace is designed to efficiently utilize the burned fuel by reflecting heat back into the enclosed compartment furnace space (approximately 6'x8'x5') and effectively insulate the furnace space from the outside area. Areas of the RAB are not compartmentized or insulated, as such, and therefore heat is allowed to convect and radiate to the surrounding space within the fire area.

c. Heat Sinks - In the E-119 test the heat sink consists of the test assemble, while within the RAB numerous heat sinks are available (i.e. concrete floor and ceiling slabs, concrete walls, equipment, supports, etc.) Also, the RAB is provided with ventilation systems which would supply cool air into the affected fire area, thereby dissipating the heat and minimizing local hot spots. In addition, in all areas where essential cable is fire protected, an automatic sprinkler system has been installed. This system would be activated at ambient air temperatures of approximately 170°F, well below a temperature which could adversly impact structural steel. This sprinkler discharge would effectively cool the ambient air, components within the area, and ultimately extinquish the fire.

The supports utilized at Waterford-3 are seismically designed and construction consists of steel members typically 4" to 8" I beams. This seismic design provides a load bearing capacity of approximately 900% greater than would be required to support the coresponding normal dead weight loading. In comparison, the supports utilized in the B and B fire test were 2 - 2 1/2" x 2 1/2" x 4" steel angles, unbraced against lateral movement and loaded in a manner which developed compressive stress (a worst case since the compressive strength of steel is less than the tensile strength). The angles were not provided with fire protective material except where immediately adjacent to the tray. During the one hour fire test the B and B supports maintained their structural integrity. Considering the advantages in physical properties (i.e. size, shape, section modulus) and the inherent over design of

the Waterford-3 supports. The Waterford-3 supports would not be adversily affected by an ASTM E-119 type temperature exposure.

Assuming that:

1. If the assumption is maintained that supports associated with essential cable trays throughout the fire areas, are impacted by an E-119 temperature excursion - the next logical application is to assume that all exposed steel located in the area would be adversily impacted. This would include process pipe, HVAC ductwork, non-essential trays and conduits, and all associated supports. This would have an extreme financial impact on utilities while adding little in the way of effective fire protection applications. E-119 temperature/time excursion exists in an area which approximates the size of a test furnace (i.e. 5' x 6' x 8')

2. Essential trays and conduits are protected by a one hour fire protective envelope, and

3. The heat developed in the space is confined, in order to permit a E-119 temperature excursion; the affected space would impact no more than one of the associated structural supports. This is due to the arrangement of support spacing which is typically 8 to 10 feet on center. Assuming the loss of structural integrity of this single support, located within the affected space, the remaining supports located on each side would provide adequate support for the tray assembly.

In summary:

1. The application of an ASTM E-119 temperature excursion throughout a fire area of the RAB is a very conservative postulate. The Fire Hazards Analysis, previously performed, has concluded that there is no need to protect structural steel supports due to the effects of in situ and transient combustible loading.

2. Structural steel supports utilized in the B and B fire qualification test were exposed to an E-119 temperature excursion and maintain their integrity.

3. The Waterford-3 supports are considerably more substantial than those tested.

4. Defense in depth is provided throughout the RAB (i.e. administrative controls, early warning fire detection, automatic suppression systems, hose stations and extinquishers).